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Prevalence of PTSD and depression, and associated sexual risk factors, among male Rwanda Defense Forces military personnel

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Abstract

OBJECTIVES To assess depression and PTSD prevalence among the Rwanda Defense Forces (RDF) and evaluate whether sexual risk behaviour, STIs, HIV and alcohol use were significantly higher among those who screened positive.

METHODS Consenting active-duty male RDF personnel, aged ≥ 21 years, completed an anonymous sexual risk survey linked to HIV rapid testing that included standardised assessments for PTSD (PCL-M), depression (CES-D) and alcohol use (AUDIT). PTSD and depression prevalence were calculated (data available for 1238 and 1120 participants, respectively), and multivariable regression analyses were conducted.

RESULTS 22.5% screened positive for depression, 4.2% for PTSD and 3.4% for both. In adjusted analyses, odds of either depression or PTSD were significantly higher in participants reporting STI symptoms (OR = 2.27, 2.78, respectively) and harmful alcohol use (OR = 3.13, 3.21, respectively). Sex with a high-risk sex partner, lower rank and never deploying were also significantly associated with depression in adjusted analyses.

CONCLUSIONS Nearly one-fourth of RDF participants screened positive for PTSD or depression, which impacts sexual risk behaviour, HIV acquisition risk and military readiness. Findings may extend to other deploying militaries and provide additional evidence of an association between mental health status and sexual risk behaviour. Effective mental health treatment interventions that also include alcohol use assessments, STI identification/treatment and sexual risk behaviour reduction are needed.

keywords PTSD, Depression and sexual risk in the Rwanda Defense Forces

Introduction

There is a growing body of evidence emphasising the importance of mental health and its association with other public health problems in resource-limited countries, particularly sub-Saharan Africa (Gureje & Alem 2000; Patel *et al.* 2004; Njenga *et al.* 2006; Gordon 2011). Several barriers to diagnosis and treatment have been identified, and only recently has considerable effort been initiated to effectively prioritise and address mental health as a global health problem (Gureje & Alem 2000; World Health Organization. 2004, 2010, 2012; Gordon

2011). While assessments among civilians within the sub-Saharan Africa region are accumulating, data among militaries, who are difficult to reach due to deployment, remote base locations and demobilisation, are scarce. Moreover, the relationship between mental health disorders and sexual risk behaviour among sub-Saharan African military populations is largely unexamined, even though several studies have shown that sexual risk behaviour (particularly inconsistent condom use), sexually transmitted infections (STIs) and HIV are more common among people with mental health disorders (Sebit *et al.* 2003; Rein *et al.* 2004; Weiser *et al.* 2004; Nduna *et al.*

2010; Adardh *et al.* 2012). Military populations, in particular, are known to have unique risk factors for STIs and HIV – for example deployments, being away from loved ones for long periods of time, attitude changes needed to survive combat that influence their sexual behaviour choices (Heathlink Worldwide. 2002; Bing *et al.* 2008; de Waal *et al.* 2009; Joint United Nations Programme on HIV/AIDS. 2011) and sub-Saharan Africa accounts for the majority of HIV infections worldwide (Joint United Nations Programme on HIV/AIDS. 2009).

High rates of trauma exposure and mental illness have been reported among civilian communities exposed to conditions more common in this region of the world, such as destabilisation, displacement, violence and other social disadvantages (Njenga *et al.* 2006; Vinck *et al.* 2007; Gordon 2011). Yet, among soldiers, who encounter additional occupation-related trauma, little is known about the prevalence of post-traumatic stress disorder (PTSD) and depression. In the spring of 1994, Rwanda was exposed to large-scale ethnic violence: more than 800 000 people were killed in a little over 3 months (Gourevitch 1998). Eighteen years have passed since the genocide, and while assessments for PTSD within the civilian community (Pham *et al.* 2004) have been reported, data on mental health disorders among military personnel in Rwanda are absent.

Baseline data examining the prevalence of PTSD and depression and corresponding risk factors (particularly sexual risk behaviour that could undermine HIV prevention efforts) among sub-Saharan African militaries are needed. Using standardised tools to measure PTSD, depression, sexual risk behaviour and HIV, we sought to identify the prevalence of PTSD and depression in the Rwanda Defense Forces (RDF) and identify associations with STIs, HIV, sexual risk behaviour and alcohol use. Because Rwanda has a relatively low HIV prevalence compared with other sub-Saharan African countries, information on STI history was collected as a sentinel marker for behaviour that could escalate HIV transmission if the disease burden within the community was elevated.

Methods

This was a cross-sectional study with data collection between October 2008 and November 2010. RDF personnel were eligible to participate if they were male, on active-duty, aged 21 years and older, and gave informed consent. The study consisted of an anonymous 60- to 90-min self-administered questionnaire linked to (standardised national algorithm) HIV rapid testing. Female soldiers comprise <1% of the RDF; due to mini-

mal data yield and difficulty in protecting confidentiality in such a small group, we did not include women in this study. Soldiers were recruited from 46 military sites throughout Rwanda, including sites near neighbouring country borders, Kigali and other urban and rural areas. Military sites were selected from a full list of all military sites to diversify regional representation and excluded sites that were deployed or involved in off-site training exercises.

Human subjects protection and ethical considerations

The study protocol was approved by human subjects protection organisations both in the United States (San Diego State University, University of California, San Diego and Naval Health Research Center) and Rwanda (Ministry of Defense, the National Commission for AIDS Control, the Ethics Review Committee and Institut National de la Statistique du Rwanda). All study documents were translated into Kinyarwanda and back-translated prior to study approval. Participation was voluntary, compensation was not provided and considerable measures were taken to ensure soldiers felt they could freely decline participation, including both written and verbal instruction on voluntary consent and leadership support of the consent process.

Data collection tools

In the self-administered survey, participants provided information on basic demographics (e.g. age, marital status, education, rank, deployment history); the presence of STI symptoms in the past 12 months (e.g. 'Have you had an abnormal discharge from your penis?' and 'Have you had an ulcer or sore on or near your penis?'); specific sex partner types in the past 3 months: (i) regular partner, cohabitating, (ii) regular partner, not cohabitating, (iii) occasional partners who were not female sex workers (FSWs) and (iv) FSWs; and alcohol use and mental health status using the Alcohol Use Disorders Identification Test (AUDIT) (Babor *et al.* 2001) PTSD Checklist, Military Version (PCL-M) (Weathers *et al.* 1993) and the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff 1977).

Data analysis

Data were entered into an Epi Info database and exported and analysed using SAS software, version 9.2 (SAS Institute, Inc., Cary, NC). *T* tests (for continuous variables) and Pearson chi-squared tests (for categorical variables) were used to assess whether there was a significant

difference for each independent variable by mental health outcome (screening positive for PTSD or depression).

Participants were categorised as having STI symptoms if they answered 'yes' to either STI question regardless of their HIV status (11 were both STI and HIV positive). Likewise, participants who reported 'no' to both STI questions (even if they were HIV positive, 21 people were HIV positive but STI negative) were categorised as not having STI symptoms. Participants were asked to report how many years they had served in the military. By subtracting years of service from the survey administration date, participants were categorised as having been in the military since 1994 (the year of the genocide) or earlier.

A standard cut-off score of ≥ 8 on the AUDIT was used to indicate harmful and hazardous alcohol use, a score of 1–7 to indicate low-risk alcohol use and 0 as no alcohol use. Participants with ≥ 2 missing responses on the AUDIT were only included if they had already met criteria for harmful and hazardous drinking (a score of ≥ 8 , $n = 11$); participants missing 1 response were included only if they could clearly be categorised based on the sum of their score and the number of missing responses (score of 0, $n = 13$; score of 1–3, $n = 53$; score of ≥ 8 , $n = 19$). Internal consistency was relatively high, with a Cronbach's alpha of 0.79.

A total of 1084 participants' data were available for both PTSD and depression (i.e. 1084 participants were in both the PTSD outcome data set and the depression outcome data set), 190 for either PTSD or depression, but not both, and $n = 33$ did not provide enough data for either assessment. There were no statistically significant differences ($p \leq 0.05$) in age, marital status, rank, years of service or religion between participants who completed assessments for PTSD or depression and those who did not.

Using the PCL-M, participants were included in analysis for PTSD if they met the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* criteria (reported a moderate or higher level of ≥ 1 intrusion symptom, ≥ 3 avoidance symptoms and ≥ 2 hyperarousal symptoms), and the sum of their score was ≥ 50 or they could clearly be categorised based on the sum of their score and the number of missing responses. Among RDF participants, 1238 met criteria for either screening positive ($n = 52$) or negative ($n = 1186$) for PTSD. Internal consistency was high, with a Cronbach's alpha of 0.91. Participants with a CES-D score ≥ 16 were considered to have screened positive for symptoms of depression. Participants were included in analysis if they were missing a response to ≤ 1 question or they could clearly be categorised based on the sum of their score and the number of missing responses. Among RDF participants, 1120

met criteria for either screening positive ($n = 252$) or negative ($n = 868$) for depression. Internal consistency was high, with a Cronbach's alpha of 0.88.

Two separate outcomes were assessed during the multivariable regression modelling: screening positive for PTSD and screening positive for depression. Factors reported in the literature to be associated with PTSD or depression (Pham *et al.* 2004; Smit *et al.* 2006) or determined to have a $p \leq 0.15$ in bivariate analysis (or a $p \leq 0.01$ for PTSD, given the small number of participants who screened positive for PTSD) were assessed during multivariable regression modelling. When examining univariate associations, a standard more inclusive cut-off ($p \leq 0.15$) was used to assess which variables should be included in the initial regression model building given that we did not want to prematurely eliminate key variables from the final regression model (e.g. variables that were not significant at the 0.05 level in the univariate analysis because of confounding, or because they were confounders or previously shown to be relevant). Variables were retained in the final model if they were determined to be significant at the $p \leq 0.05$ level using the likelihood-ratio test, after adjusting for age and marital status. Measures of association [odds ratios (ORs), 95% confidence intervals (CIs)] were calculated using the Proc Logistic procedure in SAS. All p -values were based on two-tailed tests of significance, defined as $p \leq 0.05$.

Results

A final sample of 1307 participants' data was available for analysis after applying inclusion criteria (male, active-duty RDF, aged ≥ 21 years, consenting, had corresponding HIV test results, not missing responses to substantial portions of the survey).

Of the RDF participants (252/1120), 22.5% screened positive for depression, while 4.2% (52/1238) screened positive for PTSD. Significantly more participants with STI symptoms screened positive for PTSD than participants without (31.4% *vs.* 10.7%, $P < 0.01$, Table 1). Although HIV seroprevalence was not significantly different by PTSD status (likely because of insufficient sample size), it was higher in those who screened positive for PTSD than those who did not (3.9% *vs.* 2.7%, $P = 0.65$). There was significant overlap of PTSD and depression, with almost 92% of participants who screened positive for PTSD also screening positive for depression.

After adjusting for age, marital status, STI symptoms and alcohol use, odds of screening positive for PTSD were almost three times higher among participants with

Table 1 Unadjusted and adjusted associations of demographics, sexual history and other factors by PTSD status among RDF participants

Characteristic	Total (<i>N</i> = 1238) <i>N</i> (%)	PTSD Screen positive (<i>n</i> = 52) <i>n</i> (%)	PTSD Screen negative (<i>n</i> = 1186) <i>n</i> (%)	<i>P</i>	AOR (95% CI)
Age, years, 5-year increments (<i>N</i> = 1238)					
Mean ± SD	30.9 ± 5.6	30.1 ± 4.3	31.0 ± 5.7	0.18	0.74 (0.53, 1.05)
Marital status (<i>N</i> = 1215)					
Single	380 (31.3)	13 (25.0)	367 (31.6)	0.23	1.00
Married or living with partner	800 (65.8)	39 (75.0)	761 (65.4)		1.98 (0.83, 4.68)
Divorced, widowed or separated*	35 (2.9)	0 (0.0)	35 (3.0)		
Education completed, years (<i>N</i> = 1222)					
0–3	77 (6.3)	2 (3.9)	75 (6.4)	0.64	–
4–6	481 (39.4)	19 (36.5)	462 (39.5)		
7–15	664 (54.3)	31 (59.6)	633 (54.1)		
Ever foreign deployed (<i>N</i> = 1150)					
Yes	583 (50.7)	19 (36.5)	564 (51.4)	0.04	–
No	567 (49.3)	33 (63.5)	534 (48.6)		
Military rank (<i>N</i> = 1211)					
Soldier	587 (48.5)	31 (59.6)	556 (48.0)	0.02	–
Corporal	365 (30.1)	18 (34.6)	347 (29.9)		
Sergeant or higher	259 (21.4)	3 (5.8)	256 (22.1)		
Total lifetime partners (<i>N</i> = 1123)					
0	90 (8.0)	3 (6.0)	87 (8.1)	0.03	–
1	162 (14.4)	5 (10.0)	157 (14.6)		
2	128 (11.4)	3 (6.0)	125 (11.7)		
3–5	277 (24.7)	7 (14.0)	270 (25.2)		
6+	466 (41.5)	32 (64.0)	434 (40.4)		
Occasional or FSW partner, past 3 months (<i>N</i> = 1238)					
Yes	323 (26.1)	21 (40.4)	302 (25.5)	0.02	–
No	915 (73.9)	31 (59.6)	884 (74.5)		
Any STI symptoms, past 3 months (<i>N</i> = 1203)					
Yes	139 (11.6)	16 (31.4)	123 (10.7)	<0.01**	2.78 (1.33, 5.78)
No	1064 (88.4)	35 (68.6)	1029 (89.3)		1.00
HIV positive (<i>N</i> = 1238)					
Yes	34 (2.8)	2 (3.9)	32 (2.7)	0.65	–
No	1204 (97.2)	50 (96.1)	1154 (97.3)		
Alcohol use, AUDIT score (<i>N</i> = 1135)					
No alcohol use	540 (47.6)	16 (36.4)	524 (48.0)	<0.01**	1.00
<8 (low-risk alcohol use)	484 (42.6)	15 (34.1)	469 (43.0)		0.97 (0.46, 2.03)
≥8 (harmful and hazardous alcohol use)	111 (9.8)	13 (29.5)	98 (9.0)		3.21 (1.39, 7.39)
Depression, CES-D score (<i>N</i> = 1052)					
Screen positive	232 (22.1)	45 (91.8)	187 (18.6)	<0.01	–
Screen negative	820 (77.9)	4 (8.2)	816 (81.4)		
In military since or before 1994 (<i>N</i> = 1211)					
Yes	359 (29.6)	10 (19.6)	349 (30.1)	0.11	
No	852 (70.4)	41 (80.4)	811 (69.9)		

AOR, adjusted odds ratio; AUDIT, Alcohol Use Disorders Identification Test; CES-D, Center for Epidemiologic Studies Depression Scale; FSW, female sex worker; PTSD, post-traumatic stress disorder; RDF, Rwanda Defense Forces; SD, standard deviation; STI, sexually transmitted infection.

*Combined with married category for PTSD multivariable model because of small numbers.

***p* ≤ 0.01.

STI symptoms than those without (OR = 2.78; 95% CI = 1.33, 5.78) and were more than three times higher (OR = 3.21; 95% CI = 1.39, 7.39) among participants

who reported harmful and hazardous levels of alcohol use than among those who reported no alcohol use. Almost 30% of RDF participants (380/1280) had served

in the military since or before the genocide, but this variable was not significant in the final multivariable model.

As with PTSD, participants with STI symptoms were significantly more likely to screen positive for depression. A higher percentage of depressed participants reported STIs than those without depression (20.8 *vs.* 9.2%, $P < 0.01$; Table 2). Similarly, HIV prevalence was higher among those who screened positive for depression than those who did not (3.6% *vs.* 2.4%), but not significantly different ($P = 0.32$). Among participants who screened positive for depression, 19.4% also screened positive for PTSD.

After adjusting for age, marital status, education, foreign deployment, rank, STI symptoms, having sex with an occasional/FSW partner and alcohol use, odds of screening positive for depression were significantly higher among participants who were lower ranking than higher ranking (Soldiers: OR = 2.72; 95% CI = 1.42, 5.20; Corporals: OR = 2.50; 95% CI = 1.41, 4.43), had an occasional/FSW partner (OR = 1.61; 95% CI = 1.10, 2.36), reported STI symptoms (OR = 2.27; 95% CI = 1.40, 3.69), had an alcohol use score ≥ 8 (OR = 3.13; 95% CI = 1.84, 5.32) and had never deployed to a foreign country (OR = 1.72; 95% CI = 1.20, 2.46).

Discussion

Nearly one-quarter of RDF participants (22.5%) screened positive for depression and fewer for PTSD (4.2%). Neither mental disorder was significantly associated with serving prior to or during the genocide in adjusted analyses, suggesting mental status may be related to factors other than the genocide. In adjusted analyses, STIs and harmful alcohol use were independently associated with both PTSD and depression; sex with a high-risk sex partner, lower rank and never deploying were significantly associated with depression only. HIV prevalence was higher, though not significantly different, among those with depression or PTSD. These findings suggest that soldiers with mental disorders may represent a key STI/HIV acquisition or transmission population that current HIV prevention programmes would fail to address if methods to identify and treat mental disorders are absent. Resources for effective identification and treatment of mental disorders are needed within this and other military communities, and intervention efforts should include an assessment for alcohol use, methods to identify and treat STIs, and sexual risk behaviour reduction.

Prevalence of PTSD and depression

PTSD prevalence among RDF participants was substantially lower than that reported in 2004 in the Rwanda

general population (24.8%) (Pham *et al.* 2004). However, this assessment was conducted 6 years before this study (and thus closer in time to when the genocide occurred); in predominantly high genocide-exposure regions of Rwanda, it also included women and it applied a lower cut-off score of 44 on the PCL, Civilian Version, which could increase the sensitivity and thus the number of people who screened positive. In this study, 6% ($n = 73/1199$) of RDF participants would have screened positive using this cut-off score. The prevalence observed in this study (4.2%) is consistent with levels of PTSD reported in other peacekeepers (Souza *et al.* 2011), but may result from demobilisation of soldiers with more severe or prolonged mental illness or reflect that individuals affected by PTSD after the genocide were less inclined to join the military. Additionally, it may reflect lower trauma exposure (noncombat) types of services activities or a 'healthy soldier effect', whereby the prevalence of illness is lower in military than in civilian populations (McLaughlin *et al.* 2008).

Nearly one-fourth of RDF participants (22.5%) screened positive for depression, similar to reported rates in the South African National Defence Force (Seedat *et al.* 2003). Like PTSD, the prevalence rates for depression are influenced by the types of occupational exposures (Sareen *et al.* 2007; Wells *et al.* 2010), sensitivity and specificity of the screening tool, availability of treatment and level of pre-existing mental disorders among recruits. Additional research is needed to determine the timing of illness onset, disparities in prevalence based on occupational exposure type and available resources for treatment.

Independent risk factors for PTSD and depression

Two important risk factors that remained highly associated ($P < 0.01$) with both PTSD and depression among RDF participants in the adjusted analyses were STIs (past 12 months) and screening positive for harmful and hazardous alcohol use. Also, sex with an occasional partner or an FSW (past 3 months) was significantly associated with screening positive for depression in adjusted analyses. These observations are consistent with reported associations in civilian populations in both sub-Saharan Africa and the United States (Stewart 1996; Rein *et al.* 2004; Olley *et al.* 2005; Smit *et al.* 2006; Fergusson *et al.* 2009). Among Angolan soldiers, increasing scores on a depression screening scale and alcohol before sex have been reported to be significantly associated with STI symptoms (E. G. Bing, K. G. Cheng, D. J. Ortiz, oral communication 2005). Thus, in future interventions designed to identify and treat

Table 2 Unadjusted and adjusted associations of demographics, sexual history and other factors by depression status among RDF participants

Characteristic	Total (<i>N</i> = 1120) <i>N</i> (%)	Depression Screen positive (<i>n</i> = 252) <i>n</i> (%)	Depression Screen negative (<i>n</i> = 868) <i>n</i> (%)	<i>P</i>	AOR (95% CI)
Age, years, 5-year increments (<i>N</i> = 1120)					
Mean ± SD	30.8 ± 5.6	30.6 ± 0.3	30.9 ± 5.8	0.34	1.09 (0.87, 1.37)
Marital status (<i>N</i> = 1098)					
Single	353 (32.2)	73 (29.6)	280 (32.9)	0.24**	1.00
Married or living with partner	714 (65.0)	169 (68.7)	545 (63.9)		1.56 (1.01, 2.42)
Divorced, widowed or separated	31 (2.8)	4 (1.6)	27 (3.2)		0.26 (0.05, 1.31)
Education completed, years (<i>N</i> = 1108)					
0–3	75 (7.2)	11 (4.8)	64 (7.8)	<0.01*	1.00
4–6	399 (38.0)	114 (49.4)	285 (34.8)		2.09 (0.95, 4.59)
7–15	575 (54.8)	106 (45.9)	469 (57.3)		1.48 (0.67, 3.24)
Ever foreign deployed (<i>N</i> = 1041)					
Yes	515 (49.5)	104 (43.9)	411 (51.1)	0.05**	1.00
No	526 (50.5)	133 (56.1)	393 (48.9)		1.72 (1.20, 2.46)
Military rank (<i>N</i> = 1096)					
Soldier	536 (48.9)	134 (54.3)	402 (47.4)	<0.01**	2.72 (1.42, 5.20)
Corporal	322 (29.4)	80 (32.3)	242 (28.5)		2.50 (1.41, 4.43)
Sergeant or higher	238 (21.7)	33 (13.4)	205 (24.1)		1.00
Total lifetime partners (<i>N</i> = 1022)					
0	88 (8.6)	13 (5.8)	75 (9.4)	<0.01	–
1	150 (14.7)	30 (13.3)	120 (15.1)		
2	117 (11.5)	18 (7.9)	99 (12.4)		
3–5	253 (24.8)	51 (22.6)	202 (25.4)		
6+	414 (40.5)	114 (50.4)	300 (37.7)		
Occasional or FSW partner, past 3 months (<i>N</i> = 1120)					
Yes	289 (25.8)	89 (35.3)	200 (23.0)	<0.01**	1.61 (1.10, 2.36)
No	831 (74.2)	163 (64.7)	668 (77.0)		1.00
Any STI symptoms, past 3 months (<i>N</i> = 1090)					
Yes	129 (11.8)	51 (20.8)	78 (9.2)	<0.01**	2.27 (1.40, 3.69)
No	961 (88.2)	194 (79.2)	767 (90.8)		1.00
HIV positive (<i>N</i> = 1120)					
Yes	30 (2.7)	9 (3.6)	21 (2.4)	0.32	–
No	1090 (97.3)	243 (96.4)	847 (97.6)		
Alcohol use, AUDIT score (<i>N</i> = 1033)					
No alcohol use	487 (47.1)	93 (41.9)	394 (48.6)	<0.01**	1.00
<8 (low-risk alcohol use)	445 (43.1)	80 (36.0)	365 (45.0)		0.74 (0.51, 1.08)
≥8 (harmful and hazardous alcohol use)	101 (9.8)	49 (22.1)	52 (6.4)		3.13 (1.84, 5.32)
PTSD, PCL-M score (<i>N</i> = 1084)					
Screen positive	49 (4.5)	45 (19.4)	4 (0.5)	<0.01	
Screen negative	1035 (95.5)	187 (80.6)	848 (99.5)		
In military since or before 1994 (<i>N</i> = 1096)					
Yes	323 (29.5)	57 (23.4)	266 (31.2)		
No	773 (70.5)	187 (76.6)	586 (68.8)	0.02	

AOR, adjusted odds ratio; AUDIT, Alcohol Use Disorders Identification Test; FSW, female sex worker; RDF, Rwanda Defense Forces; PCL-M, PTSD Checklist, Military Version; PTSD, post-traumatic stress disorder; SD, standard deviation; STI, sexually transmitted infection.

**p* ≤ 0.05.

***p* ≤ 0.01.

soldiers with PTSD and depression, it would be important to include an assessment for alcohol abuse and treatment for identified STIs.

Surprisingly, soldiers who had served in the military since or before the genocide were not significantly more likely to screen positive for either depression or PTSD in

adjusted analyses. Serving prior to or during the genocide was significantly associated with depression in unadjusted analysis, but in the opposite direction expected: only 23.4% of soldiers who served prior to or during the genocide screened positive for depression compared with 31.2% who screened negative for depression ($P = 0.02$). This pattern was the same for PTSD (19.6% *vs.* 30.1%, screen positive *vs.* screen negative, respectively) but not statistically significant. These observations may reflect high levels of resilience, demobilisation of particularly ill soldiers or lack of recruitment of individuals with PTSD or depression. Also, these findings suggest that mental disorders within the military are related to factors other than the genocide.

Another two factors that remained significantly associated with screening positive for depression in the adjusted analysis (but could not be assessed in the PTSD multivariable model because of small numbers) were lower military rank and never having been deployed to a foreign country. Very few data are reported in sub-Saharan African military populations, and additional research is needed to explore the reasons for observations in this specific study population. It is possible that soldiers who are depressed are less likely to be promoted or seem suitable for deployments. Conversely, soldiers who are lower ranking or less likely to be promoted (due to inability to deploy) may be more vulnerable to depression because of work-related stress and lower pay. It is possible that soldiers who do deploy feel a stronger sense of bonding, camaraderie and emotional support within the military community that may be protective against developing depression. Other studies have reported higher levels of mental disorders in individuals who have little control over a highly demanding job, less occupational social support, financial problems and other personal stress (e.g. divorce, domestic violence) (Clark *et al.* 2012; Meltzer *et al.* 2013). Given that military positions are often the most lucrative in some sub-Saharan countries, it is possible that soldiers who are frustrated with their current military status have limited options outside of the military for career advancement. No conclusions could be drawn based on the absence of a statistically significant association between depression and HIV; however, as per RDF policy, soldiers with HIV are not allowed to deploy abroad. Therefore, it is possible that HIV status has a role in the association between deployment and depression, but could not be assessed/detected within this study.

Although there were no statistically significant differences in HIV prevalence by mental status, the number of participants with HIV was very low ($n = 34$). HIV prevalence was higher among those who screened positive for either PTSD (3.9% *vs.* 2.7%) or depression (3.6% *vs.*

2.4%) than those who did not. Other data show an association between HIV and mental health within the sub-Saharan African civilian population (Sebit *et al.* 2003) and suggest that a statistically significant association was not observed in this study sample because of small numbers. In the RDF study population, significantly more participants who reported STI symptoms screened positive for PTSD or depression, showing that sexual transmission of disease is associated with mental status.

Limitations

The findings cannot be generalised to the Rwandan military as a whole because participants were not randomly sampled prior to recruitment for participation. However, soldiers were sampled from a large number ($n = 46$) of military sites across Rwanda to include urban, rural and border sites, and selected to maximise multi-region representativeness. HIV is a relatively rare event in this population, so the small number of individuals with this outcome ($n = 34$) may have limited the ability to detect an association between HIV and PTSD and depression, but STI symptoms were associated showing that sexual transmission of disease is linked. Temporality of PTSD or depression and other associated risk factors could not be discerned because of the cross-sectional study design. Also, data collections of this nature are extremely rare in sub-Saharan military populations, and while every effort was made to use screening tools that had been validated and piloted in Rwanda or other sub-Saharan African countries, or among military populations, cultural differences in interpretations behind the meanings of some questions may have under- or overestimated the prevalence rates reported in this study. Participants with extensive missing data were excluded from analysis, although we did not find significant demographic differences between those who completed the assessments and those who did not.

Conclusions

Nearly a quarter (22.5%) of RDF participants screened positive for depression and 4.2% for PTSD. In adjusted analyses, STIs and harmful alcohol use were independently associated with both PTSD and depression; sex with a high-risk sex partner was significantly associated with depression only. HIV prevalence was higher, although not significantly different, in those who screened positive for PTSD and depression. These findings suggest that mental disorders are closely associated with high-risk sexual behaviour, which could increase STI/HIV acquisition or transmission if mental health is not adequately addressed

within standard HIV prevention programmes. Neither mental disorder was significantly associated with serving prior to or during the genocide in adjusted analyses, suggesting mental status may be related to factors other than the genocide (e.g. current occupational or personal exposures). In adjusted analysis, lower rank and not deploying were also significantly associated with depression but it is unclear from these data whether depression leads to, or results from, lack of promotion or ability to deploy. Future research should include the following: (i) methods to discern specific causes or circumstances that may be contributing to mental disorder onset, including job-related exposures or stress and inadequate emotional support from family or the community; (ii) ways to better establish temporality of events (i.e. if depression follows or precedes not being promoted or deploying, if soldiers have pre-existing mental health conditions when they are recruited into the military or if they develop them after joining); and (iii) other occupational exposures that may be related (e.g. combat exposure, assault, witnessing violence). Resources for the identification of and treatment for mental disorders are needed within this and other military communities, and intervention efforts should include an assessment for alcohol use, methods to identify and treat STIs, and sexual risk behaviour reduction.

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14. ABSTRACT <p>Objectives. To assess depression and PTSD prevalence among the Rwanda Defense Forces (RDF) and evaluate whether sexual risk behaviour, STIs, HIV and alcohol use were significantly higher among those who screened positive.</p> <p>Methods. Consenting active-duty male RDF personnel, aged ≥ 21 years, completed an anonymous sexual risk survey linked to HIV rapid testing that included standardised assessments for PTSD (PCL-M), depression (CES-D) and alcohol use (AUDIT). PTSD and depression prevalence were calculated (data available for 1238 and 1120 participants, respectively), and multivariable regression analyses were conducted. results 22.5% screened positive for depression, 4.2% for PTSD and 3.4% for both. In adjusted analyses, odds of either depression or PTSD were significantly higher in participants reporting STI symptoms (OR = 2.27, 2.78, respectively) and harmful alcohol use (OR = 3.13, 3.21, respectively). Sex with a high-risk sex partner, lower rank and never deploying were also significantly associated with depression in adjusted analyses.</p> <p>Conclusions. Nearly one-fourth of RDF participants screened positive for PTSD or depression, which impacts sexual risk behaviour, HIV acquisition risk and military readiness. Findings may extend to other deploying militaries and provide additional evidence of an association between mental health status and sexual risk behaviour. Effective mental health treatment interventions that also include alcohol use assessments, STI identification/treatment and sexual risk behaviour reduction are needed.</p>					
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